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ABSTRACT

This proposal suggests library inventory procedures to meet the need for improved security in the California State University libraries and to preserve the integrity of the collections at the 19 campuses. There is a need for a reliable method of inventory for the collection as a whole, in order to determine significant changes in the collection such as changes in the number of books unaccounted for. Since a complete inventory on a regular basis would be too costly, sampling is proposed as the best method of assessing the amount of book loss, and a complete inventory would be mandated only when lost items exceeded a benchmark figure. This proposal recommends that a systematic sample of a specified number of each Library of Congress letter classification be taken every 3 years. If sample results revealed an annual loss rate of more than 1% and the loss rate remained the same after a 1 year waiting period followed by a second sample, a full inventory would be indicated. This proposal includes a detailed formula for systematic sampling, and statistical tables to aid in the implementation of the sampling formula. (Author/DMC)

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INVENTORY PROCEDURES
FOR THE LIBRARIES OF
CALIFORNIA STATE UNIVERSITY, NORTHRIDGE
AND A POSSIBLE
CALIFORNIA STATE UNIVERSITY SYSTEM GUIDE

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INVENTORY PROCEDURES FOR THE LIBRARIES
AT CALIFORNIA STATE UNIVERSITY, NORTHRIDGE
AND A POSSIBLE CSU SYSTEM GUIDE

Introduction:

In its report published in October, 1982, the CSU Board of Trustees' Audit Team expressed concern over several aspects of standard operating procedures in the libraries of the system. Among the concerns expressed, a major topic of attention was the need for improved security in the libraries and a more uniform system to preserve the integrity of the collections at the 19 campuses

This proposal addresses those concerns by establishing library inventory procedures, to be conducted on a regular basis at each campus. The inventory procedures are suggested for systemwide implementation, providing such inventories can be conducted in a cost-effective manner and can be executed without placing an undue burden on the staff of the system libraries.

Assumptions:

In order to establish viable procedures for these inventories, several basic conditions must be assumed true at all the campus libraries:

A. There is a need for a reliable method of inventory for the collection as a whole, within each CSU library, in order to determine significant changes in that collection (for example, any changes in the number or percentage of books unaccounted for).

B. A complete inventory of the collection on a regular basis is too costly and would place an unfair burden on the staff of the individual libraries.

C. Each of the 19 libraries has conducted a complete census of books in recent years, in conjunction with the automating of the circulation systems at each campus. Therefore, basic data about missing or lost items is available and a complete inventory is not required to make catalogs reflect accurately the collection.

D. Since a complete inventory on a regular basis would require a great deal of man-hours which are not readily available, sampling is the preferred method of assessing the amount of losses from the collection.

E. Because each campus already maintains a demand inventory as a result of patron requests for unlocated or missing books, a useful test for security and integrity of the collection has been operative in the past.

Objectives:

The objectives of the inventory procedures also must be agreed upon prior to the selection and establishment of such procedures. In this instance, based upon the concerns of the Trustees' Audit Team and the needs and capabilities of the 19 campus libraries, the objectives of an inventory to assess security shall be the following:

- 1) The sampling of the collection shall permit the calculation of book losses and the determination of the effectiveness of the individual library's present theft prevention procedures.
- 2) The sampling shall allow the determination of whether the rate of theft is greater in some area(s) of the collection, and if so, the sampling shall identify the area(s).
- 3) The sampling will mandate a complete inventory when lost or missing items exceed a benchmark figure.

Policy and Procedures:

Since the manner and frequency of the method of sampling must be uniform among the 19 campus libraries in order to provide valid data for the system as a whole, the policy and procedures established must be workable for each of the libraries, regardless of the size of its staff and/or its collection.

It is proposed that a systematic sample¹ of a specified number of each Library of Congress letter classification be taken every three (3) years. If sample results reveal greater than a 3% annual loss rate in the books sampled, and this loss rate is as great or greater following a one year waiting period and a second sample, a full inventory of the collection is indicated, following consultation with the President of the campus.

Proposal of Sampling Technique:

The following represents a technique based upon the foregoing assumptions, objectives and policy/procedures:

SAMPLE FOR ESTIMATING THE PROPORTION OF LOST BOOKS

The proportion of lost books in a library can be determined to a prescribed level of confidence with a minimum level of sampling by a two-stage sampling procedure.² This sample will be designed to result in a percentage of lost books that has a confidence coefficient of at least 90% and a confidence interval length of 1%. (For example, if the sample finds 3% of the books missing, one can be at least 90% confident that the actual number of missing books is between 2 1/2% and 3 1/2%). The results are applicable with equal reliability for any collection more than 10 times the size of the sample.

The sample is conducted as follows³:

1. Select a sample ¹ of 1,000 books from the shelflist ⁴.
 - a) Divide the total length of the shelflist cards in inches by 1,000
 - b) Using the resulting number of inches measure the shelflist and select the thousand sample titles (for example, if the shelflist is 3,000 inches long, select a card every 3"). Sample the entire shelflist; a few more or less cards are acceptable. Count the exact number (N_1).
 - c) If the card represents more than one physical volume, randomly⁵ choose one volume for the sample.
 - d) Compile a call number order list of the sample books, with a complete call # and a brief author-title.
2. Search for the first sample.
 - a) Search the stacks, book return areas, etc. and delete the volumes found from the call # list.
 - b) Inquire on the status of the unlocated volumes in the circulation system; delete all volumes not marked as 'on shelf'.⁶
 - c) Repeat 2a and 2b three times at one month intervals for all books not yet deleted. The books not deleted from the call # list after the third pass are considered missing.
3. Determine the size of sample required for the desired confidence level of 95% and confidence

interval length of 1%.

- a) Definition of N_2 = the desired second sample size. Definition of p_1 is the number of missing books in the first sample divided by N_1 .
 - b) Choose N_2 using Table 1, utilizing the .95 column.
For example, if $p_1 = .014$, then $N_2 = 2121$.
4. Repeat steps 1 and 2 for a total sample of N_2 books.
(If $N_2 < 1000$, sample is complete.)
- a) The first N_1 books may be used in the next sample. No further searching of N_1 books is required.
 - b) Repeat steps 1a-d for $N_2 - N_1$ books.
 - c) Repeat steps 2a-c for $N_2 - N_1$ books.
 - d) Recalculate p_2 for the total sample N_2 by dividing all books not found in both the 1000 books sample and the $N_2 - 1000$ sample by N_2 .
 - e) If $p_2 < p_1$, sample is finished and confidence coefficient is at least 95%. If $p_2 > p_1$, then look up N required for p_2 in .90 column. If $N < N_2$, then confidence coefficient is at least .90. In either case, sample is done.⁷
If $N > N_2$, then repeat steps in #4 for sample N_3 .
5. The p calculated in 4d or 4e multiplied by 100 is the % missing since the last complete inventory (for most campuses, this was probably the CLSI labeling). It will include books that are lost or stolen, books in use or misshelved for all three searches, and books that are mislabeled. An educated guess would be about 3/4 of p is the actual amount of books lost or stolen. However, each library should use its best estimate based upon past experience as to what fraction of p is actually lost or stolen. Divide p by the number of years since the last full inventory to get an annual loss rate.

SUMMARY EXAMPLE

1. Shelflist is about 5200" long. Sample of 990 (N_1) is chosen by taking 1 card every 5 1/4 inches.
2. Search process results in 14 items in N_1 being missing.
3. $p_1 = 14 \div 990$

$$p_1 = .014$$

Using Table 1, if $p_1 = .014$, then use 2121 for N_2 .

4. $N_2 - N_1 = 1131$

$5200 \div 1131 = 4.59$ ", so a book is chosen every 4.5" yeilding 1155 additional books for sample N_2 . Search process results in 20 items not found so the total missing in N_2 is 34 and the actual sample N_2 is 2145

$$p_2 = 34 \div 2145$$

$$p_2 = .016$$

For .016 $N(.95) = 2419$ and $N(.90) = 1694$. Therefore the confidence coefficient is between .90 and .95 and the sample is done.

NOTES

1. The sample used is not a random sample by rather a systematic sample. In this particular case however, the results should be the same as if it were a random sample. See Elementary Survey Sampling, 2nd Ed., by R.L. Schaeffer and others, Boston; Duxbury Press, 1979, for an explanation. Persons contemplating an inventory should also consult Book Theft and Library Security Systems, 1981-82, by Alice Harrison Bahr, White Plains, N.Y.: Knowledge Industry Publications, Inc., 1981.
2. See "A Two Step Sampling Procedure for Estimating the Proportion of Lost Books in a Library" By Bruce Miller and Marilyn Sorum, the Journal of Academic Librarianship, Vol.3, No.2, May 1977 pp 74-80 for background on the methodology.
3. It will probably take about 1 hours work for each 20 books sampled.
4. There are other possible manual ways to select sample. When the CLSI report generator is available with Release 27, it is possible that some method of automatically generating a sampling list will be practical.
5. To select random number, use a large random table or random generator. If using a table, use each digit if # of items on card is 2-9, each 2 digits if # of items on card is 11-99, etc. Use first digit on digit set that is applicable. For example, if the card has 32 items and the first two digits are 61 and then the next two are 07, use the seventh item for the sample.
6. Do not delete books with a lost status unless they were known to be lost prior to the time period for which the loss rate is being sampled. See step 5 for further related comments.
7. If you wish to compute the confidence coefficient for a confidence interval from p+e to p-e, where e = .005 (interval length .01):

Assume that N volumes are checked and that the proportion of lost volumes is p. For example, suppose 3012 volumes are checked and that 52 are missing. Then $p = 52 \div 3012 = .01726$.

Compute the number Z defined by

$$Z = (.005) \sqrt{\frac{N}{p(1-p)}}$$

For our example,

$$Z = (.005) \sqrt{\frac{3012}{(.01726)(.98274)}} \\ = 2.11.$$

(Round Z off to the nearest one hundredth.)

Look up the Z value in Table 2. For example, if $Z = 2.11$, the value in the table is .4826. Double this number to get the confidence coefficient. So in our sample the confidence coefficient is $2(.4826) = .9652$.

This means that the probability that the actual proportion of lost volumes is within .005 of our estimated proportion, .01726, is .9652. In other words, we are 96.52% confident that the actual proportion of lost volumes is between .01226 and .02226.

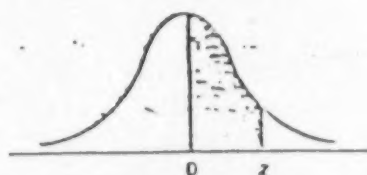
TABLE 1.

P Prop.	N Number (.95)	N Number (.90)	P Prop.	N Number (.95)	N Number (.90)
.001	154	107	.051	7437	5207
.002	307	215	.052	7575	5303
.003	460	322	.053	7713	5400
.004	612	429	.054	7850	5496
.005	764	535	.055	7987	5592
.006	916	642	.056	8123	5687
.007	1068	748	.057	8260	5783
.008	1219	854	.058	8396	5878
.009	1371	960	.059	8531	5973
.010	1521	1065	.060	8667	6068
.011	1672	1170	.061	8802	6162
.012	1822	1276	.062	8936	6257
.013	1972	1380	.063	9071	6351
.014	2121	1485	.064	9205	6445
.015	2270	1590	.065	9339	6538
.016	2419	1694	.066	9472	6632
.017	2568	1798	.067	9606	6725
.018	2716	1902	.068	9739	6818
.019	2864	2005	.069	9871	6911
.020	3012	2109	.070	10004	7004
.021	3159	2212	.071	10136	7096
.022	3306	2315	.072	10267	7188
.023	3453	2418	.073	10399	7280
.024	3599	2520	.074	10530	7372
.025	3746	2622	.075	10660	7464
.026	3891	2724	.076	10791	7555
.027	4037	2826	.077	10921	7646
.028	4182	2928	.078	11051	7737
.029	4327	3029	.079	11180	7828
.030	4472	3131	.080	11310	7918
.031	4616	3232	.081	11439	8008
.032	4760	3333	.082	11567	8098
.033	4904	3433	.083	11696	8188
.034	5047	3533	.084	11824	8278
.035	5190	3634	.085	11951	8367
.036	5333	3734	.086	12079	8457
.037	5475	3833	.087	12206	8546
.038	5617	3933	.088	12332	8634
.039	5759	4032	.089	12459	8723
.040	5901	4131	.090	12585	8811
.041	6042	4230	.091	12711	8899
.042	6183	4329	.092	12836	8987
.043	6323	4427	.093	12962	9075
.044	6464	4525	.094	13087	9162
.045	6604	4623	.095	13211	9250
.046	6743	4721	.096	13336	9337
.047	6883	4819	.097	13460	9423
.048	7022	4916	.098	13583	9510
.049	7161	5013	.099	13707	9596
.050	7299	5110	.100	13830	9683

TABLE 2.
Statistics by Example, Terry Sincich,
Dellen Pub. Co., San Francisco and
Santa Clara, CA 1982

APPENDIX STATISTICAL TABLE

TABLE 3
Normal Curve Areas



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Source: Abridged from Table I of A. Hald, *Statistical Tables and Formulas* (New York: John Wiley & Sons, Inc.) 1952. Reproduced by permission of A. Hald and the publisher.